CLAIMS

1. An ophthalmologic instrument intended for measuring aberrations of the human eye, containing a point light source which is projected on the retina and creates a virtual light source on it; its beam is scattered by the retina, then, on the way back, it passes through the optical systems of the eye and becomes phase-modulated, the modulation corresponding to the total aberrations of the eye; further, it goes into a sensor measuring the shape of the wavefront leaving the eye; the signal from the sensor is then passed to the control system of the instrument; the instrument additionally has an aberration compensation system located between the eye and the measuring system; the beam from the virtual source projected on the retina, leaving the eye, passes a system comprising a refraction compensator that controls the focusing of the beam scattered by the retina, an astigmatism compensator located at the image plane of the pupil of the eye, and a projector of test patterns, which, jointly with the refraction and astigmatism compensators, projects the image of the test pattern onto the retina.

2. The instrument described in Item 1 is distinct in that the system measuring the shape of the wavefront of the beam leaving the eye is a wavefront sensor of the Shack–Hartmann type.

3. The instrument described in Item 1 is distinct in that the refraction compensator comprises a movable prism and a dichroic mirror placed between two lenses; the dichroic mirror also functions as a beam splitter of the alignment system of the instrument.

4. The instrument described in Item 1 is distinct in that the astigmatism compensator comprises two cylindrical or toric lenses of opposed signs and power independently rotating around the optical axis of the compensator and a system for precisely setting their initial turning angle.

5. The instrument described in Item 1 is distinct in that its control system comprises a computer that processes and stores data, restores the aberrations chart, and controls the instrument following the operator's commands; the system additionally has a microprocessor controller.

6. The instrument described in Item 1 is distinct in that it additionally comprises a built-in automatic calibration system with a virtual light source as a test element which allows to precisely measure the current positions of the compensators.

7. The instrument described in Items 1–6 is distinct in that it additionally comprises an alignment system adjusting the operational distance between the eye and the instrument.

8. The device described in Item 7 is distinct in that, the alignment system uses infrared light sources for illuminating the patient's eye.

9. The device described in Item 7 is distinct in that the alignment system comprises a system with two separate channels projecting the images of marks onto the iris, containing two identical illuminating light sources, a system for the visual observation of the mutual positions of the mark images projected onto the eye – in order to determine the direction of displacing the instrument with the purpose of setting the required distance between the instrument and the eye; the optical axis of this system is located between the mark projection directions and coincides with the optical axis of the instrument; there is also a system used for the three-dimensional positioning of the instrument and/or the eye.

10. The device described in Item 9 is distinct in that the projecting system of the alignment system of the instrument comprises two mark projectors or a single projector with two identical channels located symmetrically in relation to the optical axis of the instrument at an angle to it and removed from it to a distance assuring that, when the instrument is adjusted correctly, the mark images projected onto the iris come together on it in a circle divided by cross marks.

11. The device described in Item 10 is distinct in that, with the purpose of enhancing the sharpness of images, the mark projector of the alignment system of the instrument is made as a telecentric projecting system with a large depth of field and the marks are placed in it at an angle.

12. The device described in Items 9–11 is distinct in that each mark of the projector system is made as a sector in a circle.

13. An ophthalmologic instrument intended for measuring aberrations of the human eye, containing a point light source which is projected on the retina and creates a virtual light source on it; its beam is scattered by the retina, then, on the way back, it passes through the optical systems of the eye and becomes phase-modulated, the modulation corresponding to the total aberrations of the eye; further, it goes into a sensor measuring the shape of the wavefront leaving the eye; the signal from the sensor is then passed to the control system of the instrument; the instrument additionally has an aberration compensation system located between the eye and the measuring system; the beam from the virtual source projected on the retina, leaving the eye, passes a system comprising a refraction compensator that controls the focusing of the beam scattered by the retina, an astigmatism compensator located at the image plane of the pupil of the eye, a compensator of high-order aberrations, and a projector of test patterns, which, jointly with the refraction and astigmatism compensators and the compensator of high-order aberrations, projects the image of the test pattern onto the retina.

14. The instrument described in Item 13 is distinct in that the system measuring the shape of the wavefront of the beam leaving the eye is a wavefront sensor of the Shack–Hartmann type.

15. The instrument described in Item 13 is distinct in that the refraction compensator comprises a movable prism and a dichroic mirror placed between two lenses; the dichroic mirror also functions as a beam splitter of the alignment system of the instrument.

16. The instrument described in Item 13 is distinct in that the astigmatism compensator comprises two cylindrical or toric lenses of opposed signs and power independently rotating around the optical axis of the compensator and a system for precisely setting their initial turning angle.

17. The instrument described in Item 13 is distinct in that its control system comprises a computer that processes and stores data, restores the aberrations chart, and controls the instrument following the operator's commands; the system additionally has a microprocessor controller.

18. The instrument described in Item 13 is distinct in that it additionally comprises a built-in automatic calibration system with a virtual light source as a test element which allows to precisely measure the current positions of the compensators.

19. The instrument described in Items 13–18 is distinct in that it additionally comprises an alignment system adjusting the operational distance between the eye and the instrument.

20. The device described in Item 19 is distinct in that, the alignment system uses infrared light sources for illuminating the patient's eye.

21. The device described in Item 19 is distinct in that the alignment system comprises a system with two separate channels projecting the images of marks onto the iris, containing two identical illuminating light sources, a system for the visual observation of the mutual positions of the mark images projected onto the eye – in order to determine the direction of displacing the instrument with the purpose of setting the required distance between the instrument and the eye; the optical axis of this system is located between the mark projection directions and coincides with the optical axis of the instrument; there is also a system used for the three-dimensional positioning of the instrument and/or the eye.

22. The device described in Item 21 is distinct in that the projecting system of the alignment system of the instrument comprises two mark projectors or a single projector with two identical channels located symmetrically in relation to the optical axis of the instrument at an angle to it and removed from it to a distance assuring that, when the instrument is adjusted correctly, the mark images projected onto the iris come together on it in a circle divided by cross marks.

23. The device described in Item 22 is distinct in that, with the purpose of enhancing the sharpness of images, the mark projector of the alignment system of the instrument is made as a telecentric projecting system with a large depth of field and the marks are placed in it at an angle.

24. The device described in Item 21 is distinct in that each mark of the projecting system is made as a sector in a circle.

25. The alignment system of an ophthalmologic instrument, comprising a projection system for imaging marks on the patient's eye, light sources for eye illumination, a system for the visual observation of the mutual positions of the mark images projected onto the eye for determining the direction of the instrument displacement with the purpose of setting the proper distance between the instrument and the eye, the optical axis of said visual observation system lies between the mark projection directions and coincides with the optical axis of the instrument, a system used for the three-dimensional positioning of the instrument, is distinct in that the projection system comprises two separate channels projecting the images of the marks or a single projector with two identical channels located symmetrically with respect to the optical axis of the instrument at an angle to it and displaced from it to a distance assuring that, when the instrument is aligned, the mark images projected onto the iris come together on it in a circle divided by cross marks.

26. The device described in Item 25 is distinct in that each mark of the projecting system is made as a sector in a circle.

27. The device described in Item 25 is distinct in that, with the purpose of enhancing the sharpness of images, the mark projector of the alignment system of the instrument is made as a telecentric projecting system with a large depth of field and the mark in the projector is tilted.

28. The device described in Items 25-27 is distinct in that, the alignment system uses infrared light sources for illuminating the patient's eye.

29. The method of adjusting an ophthalmologic instrument with the purpose of setting the proper distance between it and the patient's eye by illuminating the eye, projecting the images of marks onto the eye, visually observing the mutual positions of the projected images of the marks and three-dimensionally positioning the instrument is distinct in that the images of the marks are projected onto the iris of the eye.